Septic System Controls

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Septic system source control refers to the use of outreach programs to educate homeowners about the proper operation and maintenance of their septic systems to reduce the likelihood of failure. Septic systems are designed to treat wastewater by separating solids from liquids and then draining the liquid into the ground. Sewage flows into the tank where settling and bacterial decomposition of larger particles takes place, while treated liquid filters into the soil. When system failures occur, untreated wastewater and sewage can be introduced into ground water or nearby streams and water bodies.

Workers test a drain field (Source: Texas A&M University, 1996)

Pollution prevention practices are designed to restrict pollutant and nutrient loads from improperly functioning septic systems from entering local water sources. These loadings occur for a number of reasons, including improper siting, inadequate installation, or system operation failures (see Failing Septic Systems fact sheet). As many as 75 percent of all system failures have been attributed to hydraulic overloading (Jarrett et al., 1985). Failures may also occur due to lapses in the regular inspection and maintenance that are required to ensure proper operation during the design life of the septic system. Homeowners may be unaware of the age of their system and whether preemptive planning is necessary before the system fails.

Applicability

Outreach regarding septic systems controls is applicable for large lot development in rural areas that are not served by sewer. When septic systems are used for wastewater treatment, there is a need for educational outreach and training to avoid system failures for owners of both new and existing systems. Septic system maintenance education is extremely important in coastal areas for shoreline development near shellfish beds and spawning areas, where septic effluent discharges can influence water quality and lead to bed closures and algal blooms. There is also a significant need for educational outreach regarding septic system maintenance near lake shoreline developments, where nitrogen inputs can lead to lake eutrophication.

Implementation

The most effective way to control on-site wastewater problems is through a comprehensive management program. An onsite wastewater management program can reduce water quality degradation and save local governments and homeowners time and money, as well as better tracking of the performance of routine maintenance practices. This comprehensive plan is administered by one agency that has ultimate responsibility for all aspects of wastewater management, including on-site disposal systems. (see Failing Septic Systems fact sheet).

Public outreach and training are vital elements in the control of septic system failure. Many of the problems associated with improper septic system functioning may be attributed to a lack of homeowner knowledge of operation and maintenance of the system. Educational materials for homeowners and training courses for installers and inspectors can reduce the incidence of failure. Education is most effective when used in concert with other source reduction practices, such as phosphate bans and use of low-volume plumbing fixtures. Simple messages that can be conveyed to homeowners to reduce system failures and ensure proper functioning include

- Do not wait until septic system shows sign of failure. Inspect the system annually and have it pumped-out at least once every 3 years.
- Keep records of pumping and maintenance and a map of the location of your system and drainfield.
- Practice water conservation indoors and divert roof drains and surface water away from the system.
- Use caution in disposing materials down the drain. Household chemicals can kill the bacteria that make the system work and nondegradable materials (cigarette butts, etc.) can clog the system.
- Keep heavy equipment and vehicles off your system and drainfield.
- Don't cover your drainfield with impermeable surfaces that can block evaporation and the air needed for effluent treatment.

In addition to the general suggestions above, there are other management measures which can be implemented to help maintain a properly operating system. These measures include the following:

Chemical Additive Restrictions

Organic solvents are often advertised for use as septic system cleaners. Little evidence shows that such cleaners perform any useful functions, and they might instead exterminate the microbes necessary for waste treatment, resulting in increased discharge of pollutants. In addition, the chemicals themselves often contain constituents that are listed with U.S. EPA as priority pollutants. Restrictions on the use of these additives can prevent improper system operation and ground water contamination (USEPA, 1993).

Phosphorus Detergent Restrictions

Conventional septic systems are usually very effective at removing phosphorus (see the Failing Septic Systems fact sheet). However, certain soil conditions combined with proximity to sensitive surface waters can result in phosphorus pollutant loading. If such conditions are sufficiently prevalent within areas of concern, restrictions or bans on the use of detergents containing phosphate can be implemented. Eliminating phosphates from detergent can reduce phosphorus loads to septic systems by 40 to 50 percent (USEPA, 1993). As of October 1993, 17 states had enacted phosphate detergent restrictions or bans (Osmond et al, 1995).

Elimination of Garbage Disposals for Households Served by Septic System

Garbage disposals contribute to the loading of suspended solids, nutrients, and biological oxygen demand (BOD) to septic systems, as well as increasing the buildup of solids in septic tanks. Garbage disposals can double the amount of solids added to a septic tank, creating the need for more frequent pumpouts.

Proper Septic System Maintenance

Depending on soil conditions and other factors, septic systems have a failure rate of 5 to 35 percent. When they fail, septic systems can discharge untreated or partially treated wastewater into groundwater. As a result, it is important to ensure that septic systems are maintained and operating properly. This can be accomplished by homeowners or trained inspectors through regular inspections of onsite systems. During inspections, the holding or septic tank should be checked to determine whether or not pumping is necessary. Additionally, the inspection port should be opened and the baffles checked to ensure that they have not been damaged since the last inspection. The absorption field should also be checked for flooding or sogginess, which are indicators of a clogged system or excessive water use. Finally, the entire area should be checked for odors or damp or soggy areas, which are indicative of a leak in the system.

The holding tank should be pumped regularly, with the frequency depending on the capacity of the tank, the flow of wastewater, and the volume of solids in the tank. First, a tank's capacity might become too small if new high-water-use technologies such as a hot tub or whirlpool are installed, or if more people move into the house than when the system was originally installed. Second, when more people move into a house, the wastewater flow will increase, requiring more frequent pumping. Finally, if the house has a garbage disposal or if the occupation of someone in the household results in their having excessively soiled clothing, the volume of solids entering the tank might be greater than usual and require more frequent pumping. These factors should be accounted for when determining how frequently to pump a septic tank.

Table 2 lists estimates of how frequently septic tanks should be pumped on average, based on the size of the tank and household size (NSFC). These values were calculated assuming there was no garbage disposal, which can increase solids by up to 50 percent. Individuals can determine specifically when the holding tank should be pumped by occasionally checking the depth of solids and the level of scum built up on top of the water in the tank. As this can be an unpleasant chore, it is best to have the tank routinely pumped by a certified contractor approximately every 3 years.

Limitations

As with all pollution prevention measures, public ignorance about the suggested practices may be the biggest limitation to septic system source control. Many residents appear to be either unaware of or unwilling to implement the necessary steps to ensure the proper operation and maintenance of their septic systems. A recent survey of residents in the Chesapeake Bay region found that 50 percent of septic owners had not had their systems inspected within the last 3 years and that 46 percent had not had their system cleaned within the same time frame (Swann, 1999). Twelve percent of residents did not even know where their septic system was located. This finding indicates that residents are not receiving the necessary information on septic system care to prevent or reduce the incidence of failure.

Table 2. Estimated septic tank pumping frequencies in years

Tank Size (gallons)	Household Size (number of people)					
	1	2	3	4	5	6
500	5.8	2.6	1.3	1.0	0.7	0.4
750	9.1	4.2	2.6	1.8	1.3	1.0
900	11.0	5.2	3.3	2.3	1.7	1.3
1,000	12.4	5.9	3.7	2.6	2.0	1.3
1,250	15.6	7.5	4.8	3.4	2.6	2.0
1,500	18.9	9.1	5.9	4.2	3.3	2.6
1,750	22.1	10.7	6.9	5.0	3.9	3.1
2,000	25.4	12.4	8.0	5.9	4.5	3.7
2,250	28.6	14.0	9.1	6.7	5.2	4.2
2,500	31.9	15.6	10.2	7.5	5.9	4.8

Effectiveness

Failing septic systems have been linked to water quality problems in streams, lakes, shellfish beds, and coastal areas. Improvements in system operation and maintenance should be a strong element in watershed plans for those areas where septic systems are used for wastewater treatment. Public education and outreach regarding septic system operation and maintenance can be assumed to produce some positive effect on water quality, but studies on resident behaviors regarding septic pollution prevention practices are limited. Instead, effectiveness of septic source controls is most often measured in the number of informational packets mailed out or the number of attendees for training workshops.

While this may help to define the demand for information, it gives no indication of whether the operation and maintenance practices presented are implemented. To better determine whether pollution prevention outreach is being effective, residential surveys should be part of any program seeking to educate residents on septic systems and their influence on water quality.

Cost Considerations

The cost of septic system pollution prevention programs can vary greatly, depending on factors such as staff time, outreach components, and the extent of septic use within a region. Table 3 provides some examples of programs from various parts of the country and the expenditures for septic outreach.

Once a program is well established, the cost of creating educational materials and training programs decreases and funding can be redistributed to those outreach techniques that have proven to be the most successful. Programs should be sure to secure some funding for media outreach (especially television), as this often ranks as the most popular information source in surveys of resident preferences.

Table 3. Some examples of cost and staff time for septic outreach programs

Program	Expenditure	Staff time (Full time equivalent)	Components
City of Olympia, Washington	$40,000	0.5	• Flyers/brochures • Training workshops • System monitoring
Thurston County, Washington	$35,000	0.5	• Flyer/brochures • Discount coupons for septic pumping • Training workshops
Minnesota Cooperative Extension	$18,000	0.25	• Publications/videos • Flyers/brochures • Training Workshops/community Visits • Septic owners guide distributed with new permits • Satellite conferences for policy makers • Train the trainers program

References

Maine Department of Environmental Protection. No Date. *Septic Systems: How they work and How to Keep them Working.* Maine DEP, Augusta, ME.

Matuszeski, W. 1997. Notes from Bayside: Even at their best, septic systems are bad for the Bay. *Bay Journal* 7(1).

New Jersey Department of Environmental Protection and Energy. 1992. *Ground Water Protection Practices for Septic Systems*. Trenton, NJ.

NSFC. No Date. *So Now You Own a Septic Tank*. National Small Flows Clearinghouse, West Virginia University, Department of Technology Education, Morgantown, WV.

NSFC. No Date. *The Care and Feeding of Your Septic Tank*. National Small Flows Clearinghouse. West Virginia University, Department of Technology Education, Morgantown, WV.

Ohrel, R. 1995. Dealing with Septic System Impacts. *Watershed Protection Techniques* 2(1): 265-272.

Osmond, D.L., D.E. Line, J.A. Gale, R.W. Gannon, C.B. Knott, K.A. Bartenhagen, M.H. Turner, S.W. Coffey, J. Spooner, J. Wells, J.C. Walker, L.L. Hargrove, M.A. Foster, P.D. Robillard, and D.W. Lehning. 1995. *WATERSHEDS: Water, Soil and Hydro-Environmental Decision Support System*. North Carolina State University Water Quality Group, Raleigh, NC.

Olson, K., D. Gustafson, B. Liukkonen, and V. Cook. 1997. *Septic System Owner's Guide*. Minnesota Extension Service, University of Minnesota, St. Paul, MN.

Swann, C. 1999. *A Survey of Residential Nutrient Behavior in the Chesapeake Bay*. Center for Watershed Protection, Ellicott City, MD.

Texas A&M University. 1996. *Texas A&M-El Paso, UTEP Researchers Use High Tech Methods to Assess Contamination from On-Site Systems.* [http://twri.tamu.edu/twripubs/Insights/v5n2/article-5.html]. Accessed January 2001.

University of Nevada Cooperative Extension. 1992. *Understanding Your Septic System*. Reno, NV.

University of Washington Extension and Soil Conservation Service. 1992. Venturing Beyond the Flush: Septic Systems and Water Quality. *The Water Spot*, December 1992.

Storm Drain System Cleaning

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Storm drain systems need to be cleaned regularly. Routine cleaning reduces the amount of pollutants, trash, and debris both in the storm drain system and in receiving waters. Clogged drains and storm drain inlets can cause the drains to overflow, leading to increased erosion (Livingston et al., 1997). Benefits of cleaning include increased dissolved oxygen, reduced levels of bacteria, and support of instream habitat. Areas with relatively flat grades or low flows should be given special attention because they rarely achieve high enough flows to flush themselves (Ferguson et al., 1997).

Municipalities can hire professional plumbing services to remove trapped sediment and debris from storm drains with periodical flushing (Source: Drain Patrol, no date)

Applicability

This measure is applicable to all storm drain systems. The same principles can be applied to material and waste handling areas, paved and vegetated areas, waterways, and new development projects (Ferguson et al., 1997).

Limitations

While cleaning is necessary for all storm drain systems, there are limitations (adapted from Ferguson et al., 1997) as follows:

- Cleaning the storm drain by flushing is more successful for pipes smaller than 36 inches in diameter.
- A water source is necessary for cleaning. The wastewater must be collected and treated once flushed through the system.
- Depending on the condition of the wastewater, it may or may not be disposed to sanitary sewer systems.
- The efficiency of storm system flushing decreases when the length of sewer line being cleaned exceeds 700 feet.

Maintenance Considerations

Ferguson et al. (1997) report removal of 55 to 65 percent for nonorganic materials and grits and 65 to 75 percent for organics.

Cost Considerations

The cost of a vactor truck can range from $175,000 to $200,000, and labor rates range from $125 to $175 per hour (Ferguson et al., 1997). Ferguson et al. (1997) also cited costs of $1.00 to $2.00 per foot for storm drain system cleaning.

References

Drain Patrol. No date. *Services*. [www.drainpatrol.com/pages/services.html]. Accessed January 2001.

Ferguson, T., R. Gignac, M. Stoffan, A. Ibrahim, and H. Aldrich. 1997. *Rouge River National Wet Weather Demonstration Project Cost Estimating Guidelines: Best Management Practices and Engineered Controls*. Rouge River National Wet Weather Demonstration Project, Wayne County, MI.

Livingston, E., E. Shaver, and J.J. Skupien. 1997. *Operation, Maintenance, & Management of Stormwater Management Systems*. Watershed Management Institute, Inc. Ingleside, MD

Alternative Discharge Options for Chlorinated Water

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Chlorinated water discharged to surface waters has an adverse impact on local water quality. Swimming pools are a major source of chlorinated water discharged into sanitary and storm sewer systems. An average swimming pool holds 19,000 gallons of chlorinated water. Pools have high concentrations of chlorine, which is toxic to wildlife and fish.

Chlorinated water from swimming pools should not discharged to the storm sewer system or directly into a waterbody (Source: The Pool Guy, 2001)

Applicability

Many pool owners who live in cooler climates drain their swimming pools to reduce maintenance and potential damage from freezing during harsh winters. These individuals should not discharge pool water to the storm sewer system or directly into a waterbody and should investigate alternative discharge options.

Siting and Design Considerations

The Oregon Department of Environmental Quality suggests that

- Pool owners obtain permission from local sanitary sewer operators or municipal treatment plant operators and discharge to the sanitary sewer system.
- Discharge the chlorinated water to land, where it will not drain to local surface waters.
- Dechlorinate the water before draining the pool.

Montgomery County, Maryland's, Department of Environmental Protection (1997) provides the following guidelines to pool owners and operators:

- Community pools must discharge to the sanitary sewer using a surge tank.
- Residential pools must discharge backwash water to the sanitary sewer.
- If the only option for draining pool water is to discharge directly into the environment, water quality must comply with the applicable water quality criteria.
- Pool water must sit for at least 2 days after the addition of chlorine or bromine or until chlorine or bromine levels are below 0.1 mg/l.
- The pH of discharge water must be between 6.5 and 8.5 before it is discharged.
- Algicides such as copper or silver can interrupt normal algal and plant growth and should not be used.

- Total suspended solids must be below 60 mg/l—suspended particles should be allowed to settle out and the water should not appear murky. Settled material should not be discharged with pool water.
- Discharges to the environment should be directed over a land surface so that some level of filtration by soil particles can occur. The above water quality requirements also apply to land-applied water.

Limitations

Enforcement of safe discharge of chlorinated water may be difficult to achieve.

References

MCDEP. 1997. Montgomery County NPDES Municipal Separate Storm Sewer System Annual Report. MS-MO-95-006. Montgomery County Department of Environmental Protection, Rockville, MD.

Oregon Department of Environmental Quality (ODEQ). 1997. *Environmentally Safe Methods for Draining Swimming Pools*. News release. [http://www.deq.state.or.us/news/releases/archived/swimpool.htm]. Last updated October 1, 1997. Accessed June 1, 2001.

The Pool Guy. 2001. *The Pool Guy's Homepage*. [www.geocities.com/Athens/8205/]. Accessed January 2001.

Materials management

Alternative Products

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Using alternatives to toxic substances drastically reduces their presence in storm water and receiving waters. The most common toxic substances found in the home are cleaners, automotive products, and pesticides. Fertilizers, paints, and fuels are among other common hazardous substances frequently found in ground water because of improper disposal (WEF and ASCE, 1998).

Examples of alternative products include rechargeable batteries, baking soda, olive oil, vegetable oil, a lemon, a toothbrush, and a rag

Applicability

The promotion of safer alternative products should be coupled with other programs designed to reduce the presence of hazardous or toxic materials in homes and storm water runoff. Examples of such programs are hazardous materials collection, good housekeeping or material management practices, oil and automotive waste recycling, and spill response and prevention (WEF and ASCE, 1998).

Examples of commonly used products and safer alternatives are as follows (adapted from Washington State Department of Ecology):

- *Aerosols*. Pump-type or non-aerosol products should be used.
- *Art supplies*. One should purchase water-based paints or inks. They should not contain lead or other toxic materials.
- *Batteries*. Rechargeable batteries are a cost-effective alternative to disposable batteries.
- *Chemical fertilizers*. Composting yard clippings and food scraps is an option. Manure (in measured amounts) is another alternative to chemical fertilizers.
- *Gasoline*. Not driving at all is the best way to reduce gasoline use. Purchasing a super-efficient or electric vehicle is the next best alternative. Carpooling, walking, bicycling, and public transportation are other viable options.
- *Household cleaners and detergents.* Baking soda is an excellent cleanser with mild abrasive power that can be used in lieu of heavy-duty cleansers. A mixture of 1 quart water and 2 tablespoons of vinegar can be used as a window cleaner. Three parts olive oil mixed with one part white vinegar can be used for a wood cleanser. Borax and lemon juice make an excellent toilet cleaner. Many other non- or less-toxic alternatives to harsh cleansers exist. A listing of these alternatives can be found at *www.healthdept.co.pierce.wa.us/sourceprotection/alter.html*.

- *Motor Oil*. Re-refined motor oil should be used. Doing so will spur the market for recycled motor oil and decrease reliance on new oil supplies.
- *Pesticides*. Keeping homes and gardens free from food and breeding areas for insect pests prevents the need for pesticides. Onion, garlic, and marigold plants help keep garden pests at bay.

Implementation

One of the best ways to encourage homeowners to switch to alternatives to potentially harmful products is to educate them (see Proper Disposal of Household Hazardous Wastes fact sheet). Municipalities can compile a list of alternative products and post it on their web site, publish it in a newsletter, include it as an insert in a utility bill, or produce magnets or other household products with a select list of nonhazardous alternatives. Municipalities might choose to include commercially available products that have been shown to be "green" alternatives to harsh chemicals.

Limitations

In some cases, alternative products may not be readily available. In addition, cost can be a limiting factor. For example, until recently, environmentally friendly de-icing materials for roads were significantly more expensive than traditional salt (Babcock 1998). Effectiveness of alternatives may be an issue.

The biggest impediment to instituting widespread use of alternative products is public awareness. Municipal staff must convince people to change old habits or to try new products.

Effectiveness

The use of alternative products prevents their hazardous waste counterparts from being disposed of improperly and contaminating storm water.

Cost Considerations

The majority of the cost for this BMP is composed of staff hours. An alternative products campaign should be instituted in conjunction with other public awareness programs; therefore, municipalities should not experience significant cost increases.

References

Babcock, Charles R. 1998, April 27. Slick Hill Work by De-Icer Entrepreneur. *Washington Post*, A15.

Tacoma-Pierce County Health Department. 2001. *Household Hazardous Wastes: Less Toxic Alternatives for Cleaning*. Tacoma-Pierce County Health Department, Tacoma, WA. [http://www.healthdept.co.pierce.wa.us/sourceprotection/alter.html]. Last updated February 26, 2001. Accessed June 1, 2001.

Washington State Department of Ecology. *Turning the Tide on Toxics in the Home: A Guide to Safer Alternatives and Proper Disposal of Hazardous Household Products*.

Water Environment Federation (WEF)and the American Society of Civil Engineers (ASCE). 1998. *Urban Runoff Quality Management*. WEF Manual of Practice No. 23 and ASCE Manual and Report on Engineering Practice No. 87. WEF Water Quality and Ecology Subcommittee of the Technical Practice Committee and The Urban Water Resources Research Council of the American Society of Civil Engineers, Alexandria and Reston, VA.